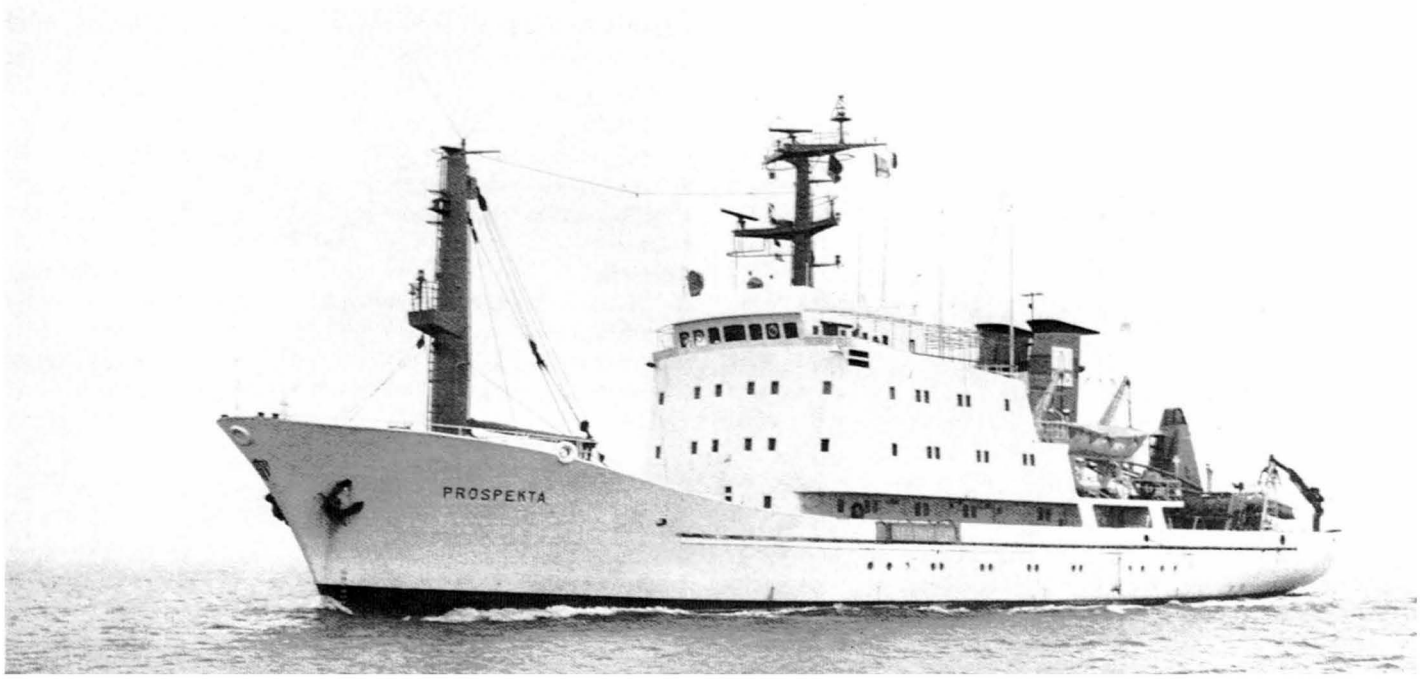
PRAKLA-SEISMOS GMBH

Geophysical Research Vessels PROSPEKTA and EXPLORA



R/V „PROSPEKTA"

Radio call signal —DEBL—

Class:
GERMANISCHER LLOYD + 100 A4 E1 + MC 16/24
General Data

Length o. a.	72,50 m (237'—11")
Length b. pp.	64,40 m (211'— 2")
Breadth mld.	11,80 m (48'— 9")
Depth tween deck	4,15 m (13'— 7")
Depth weather deck	6,55 m (21'— 6")
Draught	4,12 m (13'— 6")
Tonnage	970 GRT
Maximum speed	approx. 17 kn
Survey speed	4—6 kn
Operating range	12,000 n. m.
Continuous operating time	2—3 months
Engine plant	Klöckner-Humboldt-Deutz 2× Type S(R)BV 8M 545 N= 2 × 1,760 hp

R/V „EXPLORA"

Radio call signal —DEFG—

Class:
GERMANISCHER LLOYD + 100 A4 E2 + MC 16/24
General Data

Length o. a.	72,63 m (238'—4")
Length b. pp.	64,40 m (211'—2")
Breadth mld.	11,80 m (48'—9")
Depth tween deck	4,15 m (13'—7")
Depth weather deck	6,55 m (21'—6")
Draught	4,12 m (13'—6")
Tonnage	998 GRT
Maximum speed	approx. 17 kn
Survey speed	4—6 kn
Operating range	12,000 n. m.
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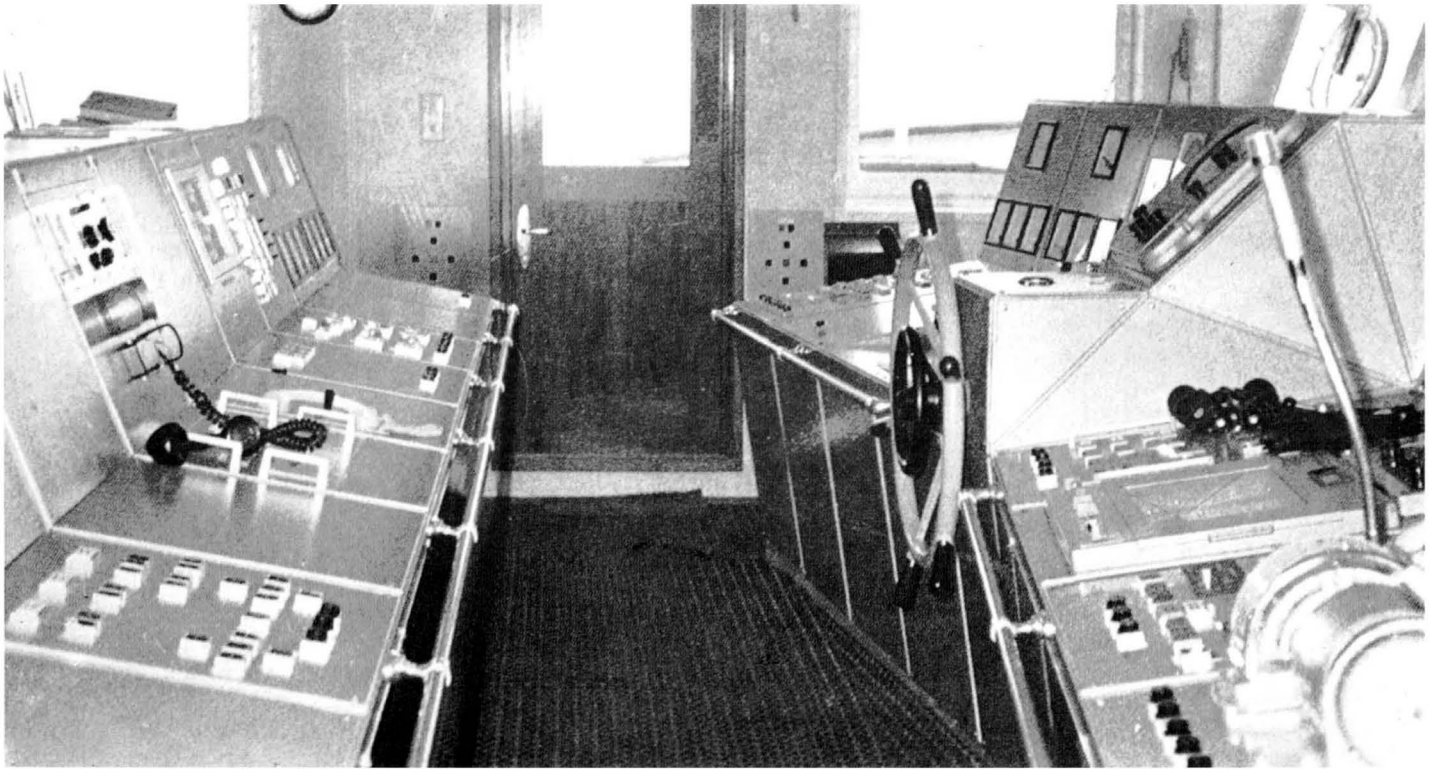
Engine plant	Klöckner-Humboldt-Deutz 2× Type S(R)BV 8M 545 N= 2 × 1,760 hp

Two multi-purpose geophysical research vessels, sailing under German flag · Home Port: Bremen German and international registry

As a result of about twenty years exploration activity — especially in the bad weather areas of Northern Europe — PRAKLA-SEISMOS designed, constructed and tested a completely new type of research vessel for combined geophysical surveys. This type of vessel — PROSPEKTA has operated successfully since August 1970, EXPLORA since May 1973 — does not only serve as a working platform, but is a part of an integrated survey system allowing simultaneous reflection and refraction seismic, gravimetric, magnetic and bathymetric surveys.

View inside the wheel house to the ship's operation and control desk



► The main task of the ships is to explore the sedimentary beds of the continental shelf by means of the seismic reflection method, designed to look for tectonic elements which might point to the possibility of oil or natural gas accumulations below the sea bottom. In addition, the gravity and the magnetic field of the earth are continuously observed, to provide further information for the subsequent geophysical and geological interpretation of the seismogram sections. On request, seismic refraction data are recorded simultaneously using sonobuoys for data transmission.

To meet these requirements, also in view of economic aspects, PRAKLA-SEISMOS GMBH proceeded to develop and construct special research vessels, which are appropriately planned from the very beginning and optimally adapted to the nature of work. Based on good experience in cooperating with shipping companies during construction and operation of such vessels, the projects „PROSPEKTA" and „EXPLORA" were undertaken by so-called part-ship shipping companies formed by PRAKLA-SEISMOS GMBH and SLOMAN NEPTUN Schiffahrts-Aktiengesellschaft.

The results of this cooperation are fast and modern research vessels of good seaworthiness, which are equipped according to the latest standard. High value was set to an extensive automation of both vessels and of the survey technic, but also on comfortable offices, laboratories and living quarters for the marine and seismic crews. The size and the conception of the vessels guarantee that all recognizable future technical and seismic developments can be met.

► Both vessels are built as single-screw freedecker with bulb bow and with an aluminium superstructure above the boat deck; they have good seaworthiness, stability, trimming possibilities and an excellent manoeuvring capacity. They are equipped with two directly reversible KHD diesel engines of 1,760 hp at 500 revs. per minute each, which drives via gear an infinitely variable pitch propeller either singly or together. The speed of the vessels can thus be optimally regulated. The revolutions of the engines are to a certain extent independent of the desired speed, so that interfering vibrations of the vessel can be excluded.

The maximum cruising speed is approximately 17 knots, but 4 to 6 knots can be maintained without any problem during survey operations. The engines are controlled fully automatically from the bridge, where all switches and control instruments are housed in two desks. The ships' machinery is controlled electronically and operates continuously for 16 hours without maintenance. The combined action of variable pitch propellers, streamlined displacement rudders with high duty steering gears and bow thruster units of 4 mts. enables quick course corrections in any direction.

The cruising range of both vessels is about 12,000 nautical miles. Tanks for water, fuel and lubricants, cold-storage and storage chambers, and fresh water plants with a daily output of about 16 tons each enable the crews to work continuously at sea for at least three months without having to restock supplies. In addition to this storage capacity there are cargo holds totalling about 20,000 cu. ft.

The loading equipment consists of one derrick crane with 8 mts. of lifting capacity and one electro-hydraulic deck crane with a lifting capacity of 5 mts.

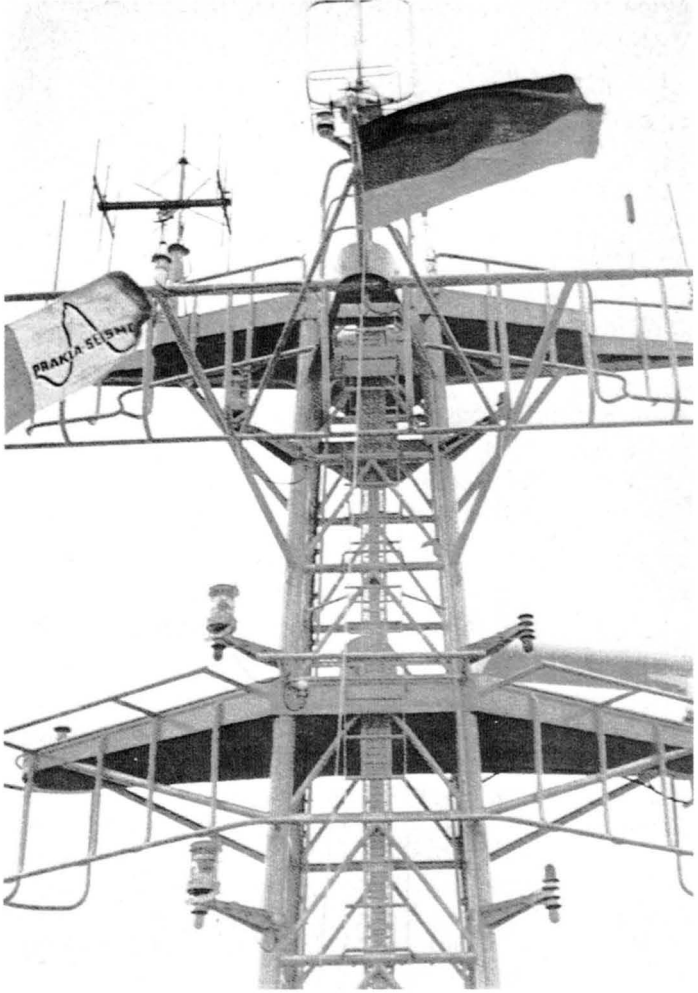
A generator plant comprising five generators provides the power supply for each vessel, the total output being 1,075 KVA at 380 V and 50 cps. Stabilization of the power supply system is achieved by a generator connexion with automatic inclusion of an additional generator in case of sudden insufficiencies of power.

► The living quarters on board both vessels correspond to highest standards. Accommodation in single or double cabins is provided for a total of 38 persons on each boat. Four apartments consisting of living room, bedroom and washroom with shower and W. C. serve as accommodation for head personnel, including the client's representative or control engineer. A modern galley is located close to a large mess hall and to a cafeteria, enabling self-service or service by only one steward respectively. The airconditioning installation consists of two separate systems, thus meeting the individual requirements for the living quarters and for the instrument and technical rooms under tropical conditions as well as in arctic regions.

► The life saving and fire fighting equipment on board the vessels correspond to the respective German regulations. In accordance with the International Convention for the Safety of Life at Sea 1960 and 1966 and its amendments, the „EXPLORA" carries two polyester motor pinnaces for 38 persons each. These life saving appliances are supported by highpowered winches. They are driven by DAF diesel engines of about 125 hp at 2,100 revs. per minute yielding a maximum speed of 14 knots.

► The technical and scientific load of both vessels, however, is at least as impressive as the advanced ship equipment itself. Most modern electronic survey and navigation equipment guarantees high grade performance with optimal accuracy in geophysical data recording all over the world.

In contrast to procedures previously used, the acoustic impulses for marine seismic surveys are emitted by two batteries of air guns, suspended from steel frames and towed under water at starboard and port side of the vessels. A large selection of air guns can thus be operated simultaneously. Individual air guns are triggered by an electric pulse, whereas triggering is precisely adjusted to generate an optimal signal. Depending on the specifications of the air gun array required, guns of different volumes ranging from 10 to 480 cu. in. are combined to tune the arrays for maximum power output, optimal bubble suppression and spectrum shaping. The air for this system is generated by two BAUER compressors and four JUNKERS compressors with a maximum capacity of 800 cu. ft. per minute at 2,000 psi on board „PROSPEKTA" as well as „EXPLORA". Control stations allow the independent distribution and timely release of sound impulses in accordance with the recording sequence. These energy souces are absolutely harmless to fish and other marine life.

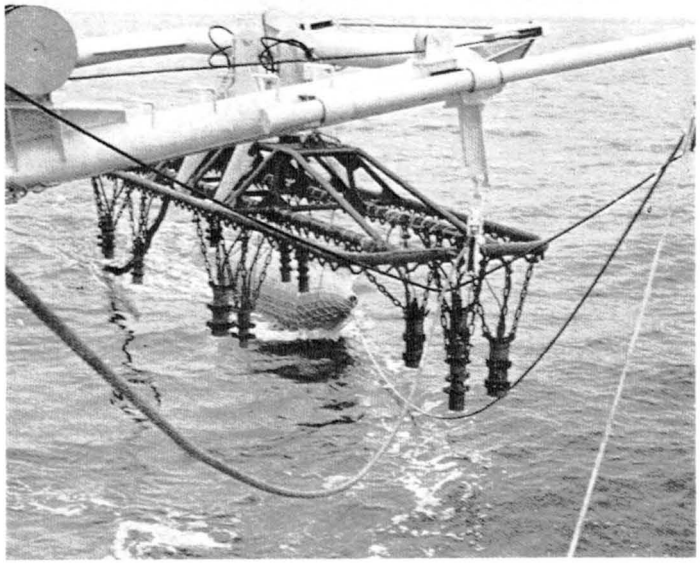


EXPLORA's signal mast construction absorbing various navigation antennae, as Sat-Nav, Radars, ADF etc.

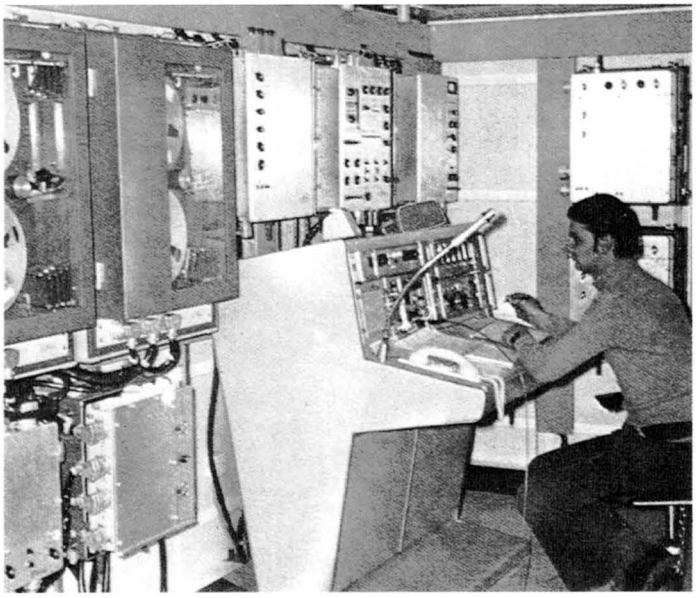
▶ The reflected seismic waves are picked up by 2.400 m streamer cables carrying about 1.500 acceleration insensitive hydrophones with high signal to noise ratio. The streamer cable consists of 48 detector groups, each of which is 50 m long and contains 32 hydrophones in an equidistant distribution. Either two of the groups can be joined together, resulting in a group of double length with hydrophones in a tapered array. Streamer cables of 72 and 96 groups are available. Quick disconnect couplers with all streamers enable fast cable interchanges. Accessories include tow cables, damping sections, depth indicators, and remotely controlled underwater buoys, which keep the streamer cables behind the vessel at the desired depth. The alignment of the streamer cable can be determined by tracking a tail-end buoy with an automatic radio direction finder. The capacity of the cable reels at the stern exceed the actual requirement.

The seismic data, picked up by the hydrophones, are recorded digitally on 21 track TIAC format magnetic tapes for later processing, using TI DFS IV systems, with up to 96 channels, and 4 magnetic tape recorders. The sampling rate of recording can be varied, but is usually 4 or 2 ms. An automatic interlock system provides failsafe operation. Continuous quality control of the recorded data is achieved with read-after-write technique and after D/A conversion by an electrostatic oscillograph with 56 traces and by a cross-section camera using a single trace for continuous profiling.

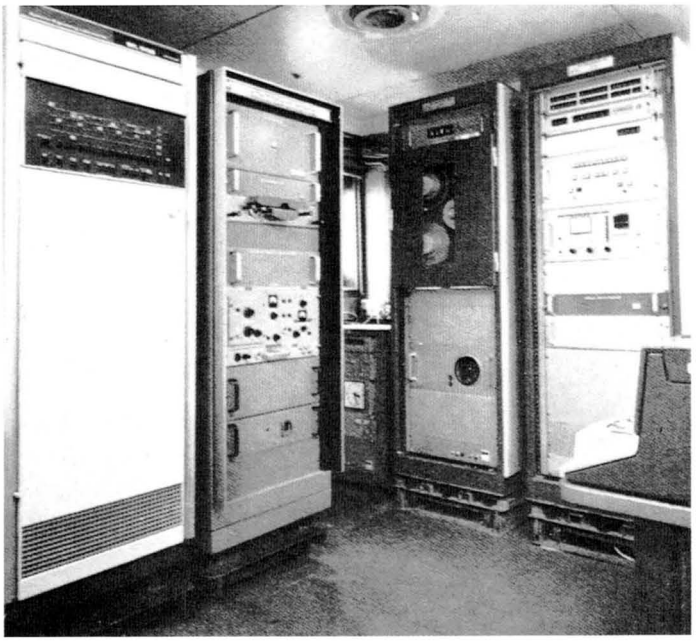
▶ A marine gravimeter, type ASKANIA Gss 3, is used simultaneously. It is installed on a gyro-stabilized platform at the intersection of the ship's axes of roll and pitch, in order to compensate for the effect of inclinations of the ship's hull. — This is also, for the same reason, the place of the gyro-compass, which is connected to slave indicators on the bridge.



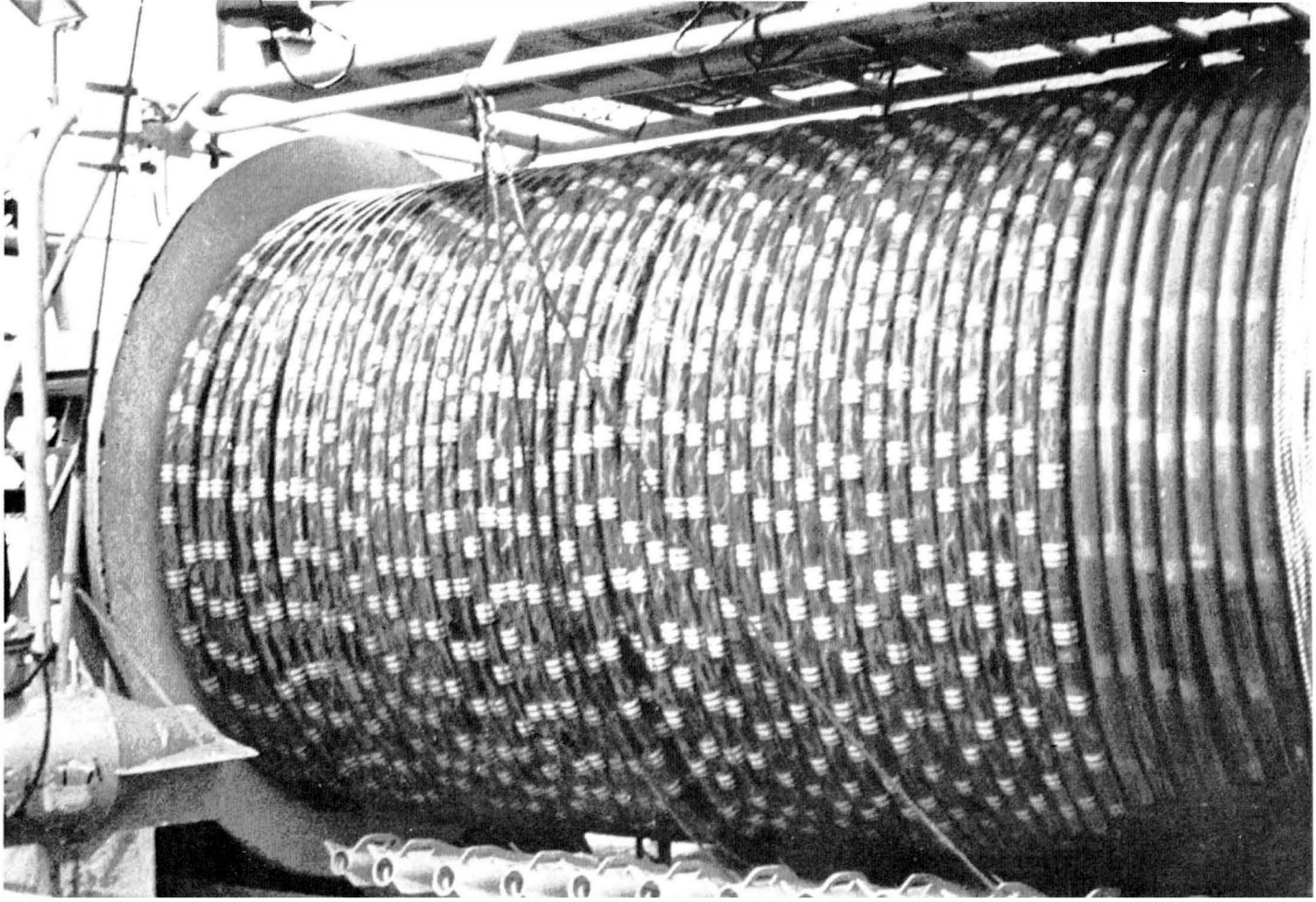
The port side „S" Air Gun Array before lowering into the sea



View inside the seismic instrument room, showing the control desk in front of the DSF IV recording unit



View to a part of the navigation control centre behind the wheel house



Streamer of 2,400 m length in resting position on the streamer winch.
Upper corner of this picture shows the TV-camera, controlling the work deck

► The magnetic field is measured by a proton precession magnetometer, type GEOMETRICS G 803. The sensor, towed behind the vessel at a distance of about 200 m, guarantees that magnetic effects of the ship's hull and of the on board equipment are eliminated.

► The magnetic records, as well as bathymetric data and data taken from the gravimeter, are recorded digitally on 9track field tape by central data logging units and moreover analog on paper chart for control purposes.

► Corresponding to the modern geophysical equipment, the vessels are equipped with navigation systems of the latest standard for accurate positioning under any conditions. An **I**ntegrated **N**avigation and **D**ata **A**cquisition **S**ystem with Automatic Ship Steering (INDAS) was developed and set up by PRAKLA-SEISMOS GMBH to extend the range of operation, as compared to the use of conventional hyperbola and trilateration methods.

An essential part of INDAS is a computer controlled navigation system, consisting of an ITT satellite receiver, a universal computer for the calculation of coordinates and for integration of a Sonar Doppler or other navigation systems. The satellite receiver enables positioning by using orbit data of satellites orbiting the earth on polar routes. Among other things accessories include a velocimeter, an inclinometer, the gyro-compass, an EM-log, an interface, and the integration programs. As long as satellite navigation is used this system works independently of onshore stations on either bottom or water track. The new Doppler unit DOLOG 12 provides a high degree of accuracy on bottom track in water depths down to about 600 m. Other navigation systems like DECCA Hi-Fix, DECCA Seasearch, DECCA Main Chain, LORAN C, OMEGA, and XR SHORAN can as well be fully integrated.

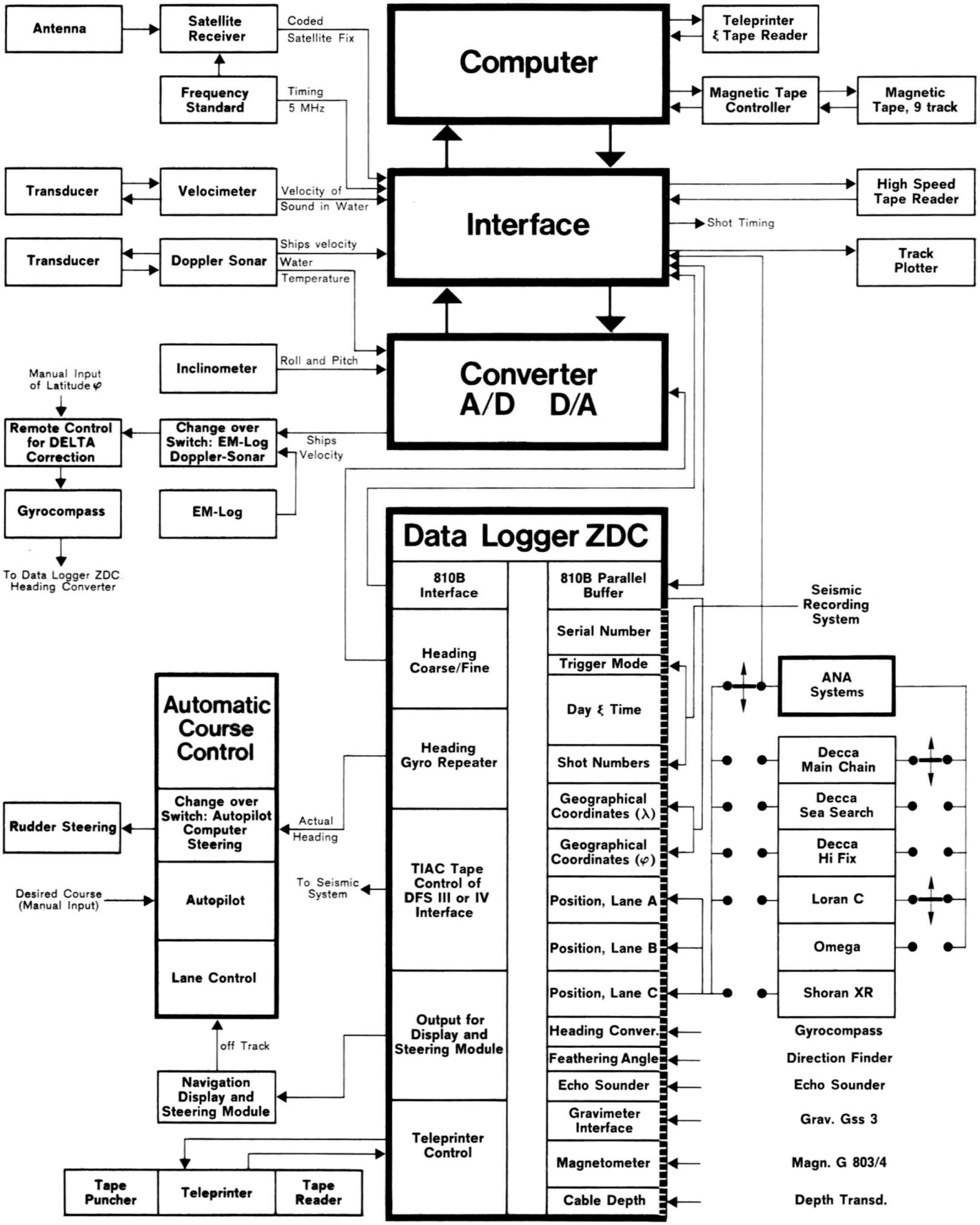
The same applies to the PRAKLA-SEISMOS system ANA C, which was developed particularly for deep sea areas beyond the range of standard electronic systems. ANA C is a two range navigation system using a caesium frequency standard as time reference, and operating with signals from any frequency stabilized transmitter stations.

In addition to the navigation equipment, the INDAS system contains an automatic ship steering unit with computer controlled course correction, and a data logger system, where all the non-seismic data, i. e. water depths and magnetic, gravity, navigation, and statistical data, are recorded digitally on 9track magnetic tape and/or punch tape. Another computer deals with the logical connexion of these data which, for control reasons, are simultaneously printed out by a teleprinter.

The navigation systems of both vessels, „PROSPEKTA" and „EXPLORA", are supplemented by modern nautical and radio equipment, the most important of which are a survey echo sounder with digital readout, a horizontal echo sounder, two radar sets, a crystal master clock system, a radio station, and a weather station with meteorological chart printer.

► Summing up, it can be concluded that PRAKLA-SEISMOS GMBH has made every effort, not only to keep abreast of the technical development in the field of marine geophysical research, but to be a step ahead of it. The conception of the new vessels which combine optimally all the important aspects of either side, client as well as geophysical contractor, as there are high speed of the vessels, good seaworthiness, wide range of operation, accurate recording of data, high flexibility with respect to the navigation systems used, economical working methods through extensive automation and comfortable accommodation on board of the ships is for the benefit of all the parties concerned. With „PROSPEKTA" and „EXPLORA" PRAKLA-SEISMOS GMBH places vessels at the oil companies' disposal which, to all intents and purposes, can cope with the requirements in the field of worldwide marine geophysical surveys.

A block diagram of the integrated navigation system and non seismic data recording



Main Equipment Specification

R/V „PROSPEKTA"

▶ Nautical and Radio Equipment

1 magnetic compass (reflection)
1 spare compass
1 gyro-compass, ANSCHÜTZ Standard IV, with automatic failure alarm and 3 slave indicators
1 survey echo sounder with digital readout, DESO with EDIG from KRUPP ATLAS
1 base-line control unit
1 horizontal echo sounder, Super Lodar of ELAC
1 EM-log, PLATH-NAVIKNOT
1 radar set, DECCA TRANSAR 519 for normal range
1 radar set, DECCA TRANSAR 326 for close area

1 crystal master clock system with repeaters
1 radio station DEBEG with 1,2 kw ssb
1 spare and automatic emergency transmitter
1 master receiver
1 spare receiver
1 autoalarm unit
1 safety receiver
1 vhf radio telephone with 28 channels, (56 channel operation possible)
1 automatic direction finder TELEFUNKEN TELEGON V for determination of feathering angle

▶ Integrated Navigation and Data Acquisition System with Automatic Ship Steering (INDAS)

1 ITT satellite receiver 5001
1 MARQUARDT DOPPLER SONAR 2020A, range 200 m
1 NUS-velocimeter
1 inclinometer
1 ANSCHÜTZ gyro-compass standard IV, with automatic DELTA-correction and electronic autopilot
navigation receivers PRAKLA-SEISMOS ANA C, LORAN C, OMEGA, DECCA Hi-Fix, DECCA Seasearch, DECCA Main Chain, SHORAN XR can be easily and quickly adapted to the different requirements
1 PRAKLA-SEISMOS automatic ship steering unit
1 SYSTEMS computer 810 B
1 teleprinter, SIEMENS T 200
1 magnetic tape recorder
1 punched tape reader, CHALCO 5101
1 plotter, HOUSTON INSTRUMENTS 6655
1 data logger, PRAKLA-SEISMOS ZDC
1 interface
2 navigation displays, PRAKLA-SEISMOS

▶ Seismic Equipment

1 digital recording system, TI DFS IV, 60 channels and DUAL magnetic tape transport
1 electrostatic oscillograph, ETL SDW 200, 64 channels
1 cross-section camera, GSC MR 101, 4 channels
1 waterbreak system
1 PRAKLA-SEISMOS „MULTI-DYNE" cable, 2,400 m length, neutral buoyant, with 48 stations, each containing 32 accelerating insensitive hydrophones
1 cable reel with hydraulic drive (diameter of reel 2,7 m, width 5,0 m)
2 BAUER compressors, 2,000 psi, 265 cu. ft./min., each
4 JUNKERS compressors, 2,000 psi, 72 cu. ft./min., each
30 air guns of 10 to 480 cu. in. (incl. spares) with towing and floating devices

▶ Non-Seismic Geophysical Equipment

1 ASKANIA-seagravimeter Gss 3 on gyro-stabilized platform
1 proton magnetometer GEOMETRICS G 803 with towed sensor

R/V „EXPLORA"

▶ Nautical and Radio Equipment

1 magnetic compass (reflection)
1 spare compass
1 gyro-compass, ANSCHÜTZ Standard IV, with automatic failure alarm and 3 slave indicators
1 survey echo sounder with digital readout, DESO with EDIG from KRUPP ATLAS
1 base-line control unit, ANSCHÜTZ
1 horizontal echo sounder, Super Lodar of ELAC
1 EM-log, PLATH-NAVIKNOT
1 radar set, DECCA RM-S, relative motion
1 radar set, DECCA anticollision, true motion or relative motion with electronic markers
1 master clock system
1 radio station HAGENUK with
1 master transmitter 2,0 kw with digital frequency synthesizer
1 spare and automatic emergency transmitter
1 master receiver with digital frequency synthesizer
1 spare receiver
1 autoalarm unit
1 safety receiver
1 vhf radio telephone with 56 channels
1 automatic direction finder ITT-ADF 2200 for determination of feathering angle

▶ Integrated Navigation and Data Acquisition System with Automatic Ship Steering (INDAS)

1 ITT satellite receiver 5001
1 ATLAS Alpha DOPPLER, DOLOG 12, range 600 m
1 NUS-velocimeter
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navigation receivers PRAKLA-SEISMOS ANA C, LORAN C, OMEGA, DECCA Hi-Fix, DECCA Seasearch, DECCA Main Chain, SHORAN XR can be easily and quickly adapted to the different requirements
1 PRAKLA-SEISMOS automatic ship steering unit
1 SYSTEMS computer 810 B
1 TELETYPE ASR 33
1 magnetic tape recorder
1 punched tape reader, CHALCO 5101
1 plotter, HOUSTON INSTRUMENTS 6655
1 data logger, PRAKLA-SEISMOS ZDC
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2 navigation displays, PRAKLA-SEISMOS

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1 digital recording system, TI DFS IV, 60 channels and DUAL magnetic tape transport
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▶ Non-Seismic Geophysical Equipment

1 ASKANIA-seagravimeter Gss 3 on gyro-stabilized platform
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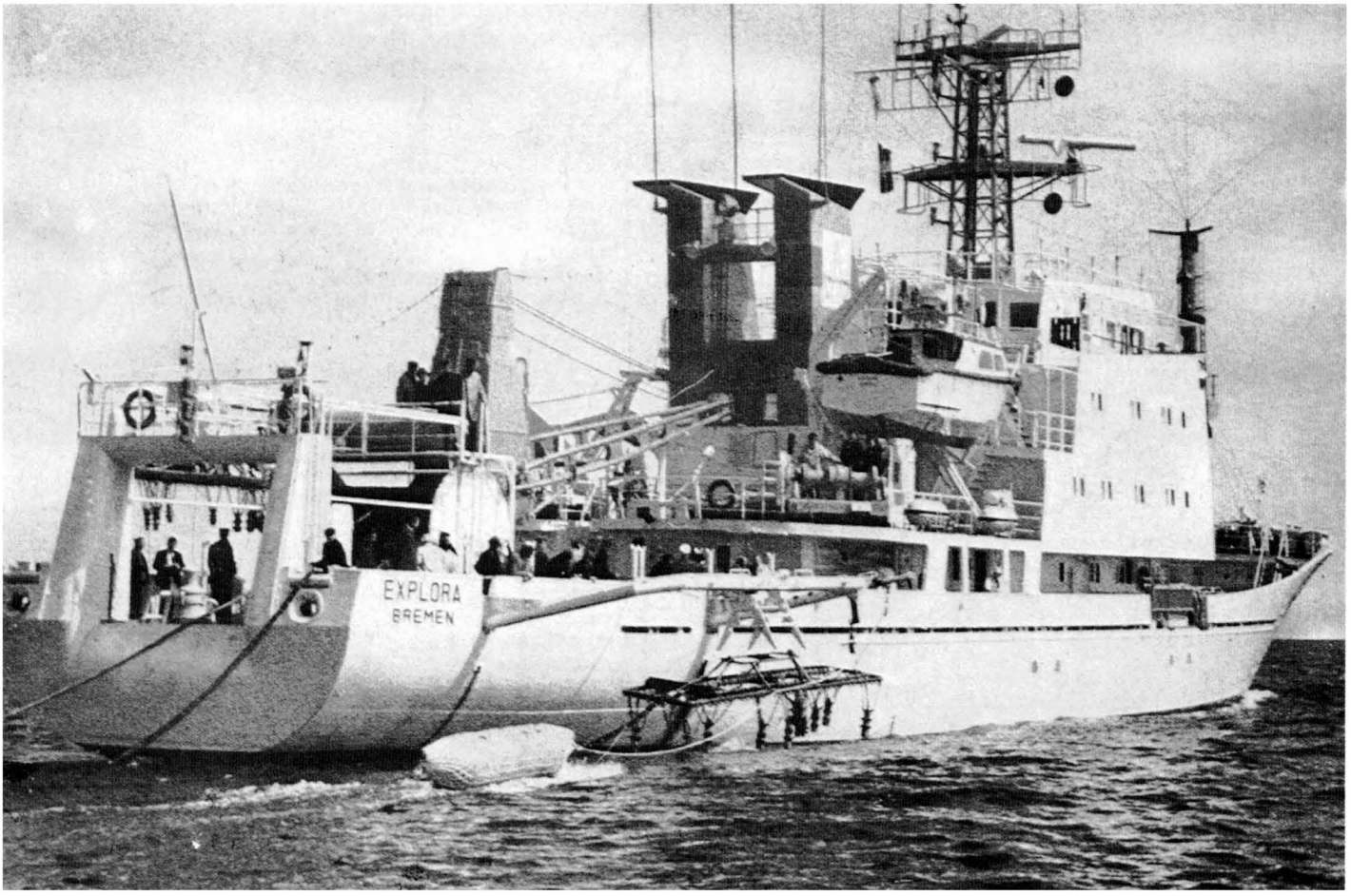

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